AMENDMENTS TO THE CLAIMS

The following list of claims is intended to replace all prior versions or listings of claims in the application.

<u>Listing of Claims:</u>

1. – 9. **(Canceled)**

10. **(Currently Amended)** A machine comprising:

a computing device for determining an implied volatility of an American option, wherein said device is configured to:

generate a ~~binomial~~ tree having a plurality of nodes, each node corresponding to a different sub-period of time during which the American option can be exercised prior to the time when the option expires;

compute a value for node vega at each node of the ~~binomial~~ tree for the corresponding sub-period of time using a single <u>value of</u> volatility <u>that is the same</u> for all nodes in the ~~binomial~~ tree;

compute a value for vega for the ~~binomial~~ tree using the values for node vega computed at the nodes; and

compute a value for the implied volatility of the American option using the value of vega computed for the ~~binomial~~ tree.

11. **(Previously Presented)** The machine of Claim 10, wherein the computing device is configured to compute the value for node vega at a node as the exact derivative of the option price with respect to the volatility when the option is not exercised at the sub-period of time corresponding to the node.

12. **(Currently Amended)** The machine of Claim 10, wherein the computing device is configured to compute the value for node vega at a node as a function of [[the]] <u>a</u> security price of the option when the option is exercised at a sub-period of time corresponding to the node.

13. (**Currently Amended**) The machine of Claim 12, wherein the security price of the option ~~computing device is configured to compute the value for node vega at a node as a function of the~~ is an index price of the option ~~when the option is exercised at a sub-period of time corresponding to the node~~.

14. (**Currently Amended**) The machine of Claim 10, wherein said computing device is configured to ~~calculate~~ compute the value for the implied volatility of the American option iteratively using new values for node vega in each iteration until the computed price of the American option converges to the market price of the American option.

15. (**Currently Amended**) The machine of Claim 14, wherein said computing device is configured to ~~calculate~~ compute the value for the ~~new values for~~ implied volatility in each iteration using the Newton-Raphson method.

16. (**Currently Amended**) The machine of Claim 10, wherein said computing device is configured to ~~calculate~~ compute the price of the option at each node at the same time as the computing device ~~calculates~~ computes the value of node vega at the node.

17. (**Currently Amended**) A method for determining an implied volatility of an American option, wherein said method comprises:

generating a ~~binomial~~ tree having a plurality of nodes, each node corresponding to a different sub-period of time during which the American option can be exercised prior to the time when the option expires;

computing a value for node vega at each node of the ~~binomial~~ tree for the corresponding sub-period of time using a single value of volatility that is the same for all nodes in the ~~binomial~~ tree;

computing a value for vega for the ~~binomial~~ tree using the values for node vega computed at the nodes; and

computing a value for the implied volatility of the American option using the value of vega computed for the ~~binomial~~ tree

wherein each of the computing steps is performed by a computing device.

18. **(Currently Amended)** The method of Claim 17, wherein the value for node vega at a node is ~~calculated~~ computed as the exact derivative of the option price with respect to the volatility when the option is not exercised at the sub-period of time corresponding to the node.

19. **(Currently Amended)** The method of Claim 17, wherein the value for node vega at a node is ~~calculated~~ computed as a function of [[the]] a security price of the option when the option is exercised at a sub-period of time corresponding to the node.

20. **(Currently Amended)** The method of Claim 19, wherein the security price of the option ~~value for node vega at a node is calculated as a function of the~~ is an index price of the option ~~when the option is exercised at a sub-period of time corresponding to the node~~.

21. **(Currently Amended)** The method of Claim 17, wherein computing the value of the implied volatility of the American option comprises ~~calculating~~ iteratively computing new values for node vega at the nodes ~~iteratively using new values for~~ in each iteration until the computed price of the American option converges to the market price of the American option.

22. **(Currently Amended)** The method of Claim 21, wherein ~~calculating~~ the value of the ~~new values for~~ implied volatility ~~in each iteration comprises~~ is computed iteratively using the Newton-Raphson method.

23. **(Currently Amended)** The method of Claim 17, further comprising computing ~~wherein node vega and~~ the price of the option at each node ~~are calculated~~ at the same time as the value for node vega is computed for ~~each~~ the node.

24. **(Currently Amended)** The machine of claim 10, wherein said machine is configured to compute a value for vega for the ~~binomial~~ tree recursively using values for node vega computed at the nodes.

25. **(Currently Amended)** The method of claim 17, wherein said computing of a value for vega for the ~~binomial~~ tree is conducted recursively using values for node vega computed at the nodes.

26. **(Currently Amended)** The machine of Claim 10, wherein said computing device is configured to compute a value for the option price at each node and the value for node vega for the corresponding sub-period of time using the option price of a node corresponding to a subsequent period of time.

27. **(Currently Amended)** The method of Claim 17, further comprising the step of computing a value for the option price at each node and wherein the value for the node vega for a sub-period of time is computed using the option price of a node corresponding to a subsequent period of time.

28. **(Currently Amended)** A machine comprising:

a computing device for determining implied volatility of an American option, wherein said device is configured to:

iteratively generate a new tree for each new value of volatility, the tree having a plurality of nodes, each node corresponding to a different sub-period of time during which the American option can be exercised prior to the time when the option expires;

calculate a value of vega for each tree using values of the option price calculated at nodes of a single tree using a single value of volatility that is the same for all nodes in the single tree; and,

calculate the value of the implied volatility of the option using the values calculated for vega for the trees.

29. **(Currently Amended)** The machine of Claim [[10]] 11, wherein~~, when the option is not exercised at a sub-period of time *i* corresponding to a node,~~ said computing device is configured to compute, when the option is not exercised at a sub-period of time *i* corresponding to a node, the value for node vega at the node as:

$$\frac{\partial C_i}{\partial \sigma} = (\frac{1}{R}) \times [p\frac{\partial C_{i+1}^{UP}}{\partial \sigma} + (1-p)\frac{\partial C_{i+1}^{DOWN}}{\partial \sigma} + (C_{i+1}^{UP} - C_{i+1}^{DOWN})\frac{\partial p}{\partial \sigma}],$$

where C_{i+1}^{UP} and C_{i+1}^{DOWN} are the option prices at the end of the sub-period i when the price moves up and down, respectively, σ is volatility, [[and]] p is a risk-neutral probability, and $R=exp([r-q]h)$, where h is the size of the sub-period of time i, r is the interest rate and q is the continuous dividend yield.

30. **(Currently Amended)** The machine of Claim [[10]] 12, wherein~~, when the option is exercised at a sub-period of time *i* corresponding to a node,~~ said computing device is configured to compute, when the option is exercised at a sub-period of time *i* corresponding to a node, the value for node vega at the node as $\frac{\partial C_i}{\partial \sigma} = \frac{\partial S_i}{\partial \sigma}$, where S_i is the security price at the beginning of the sub-period of time i and σ is volatility.

31. **(Currently Amended)** The method of Claim [[17]] 18, wherein, when the option is not exercised at a sub-period of time i corresponding to a node, the value for node vega at the node is computed as:

$$\frac{\partial C_i}{\partial \sigma} = (\frac{1}{R}) \times [p\frac{\partial C_{i+1}^{UP}}{\partial \sigma} + (1-p)\frac{\partial C_{i+1}^{DOWN}}{\partial \sigma} + (C_{i+1}^{UP} - C_{i+1}^{DOWN})\frac{\partial p}{\partial \sigma}],$$

where C_{i+1}^{UP} and C_{i+1}^{DOWN} are the option prices at the end of the sub-period i when the price moves up and down, respectively, σ is volatility, [[and]] p is a risk-neutral probability, and $R=exp([r-q]h)$, where h is the size of the sub-period of time i, r is the interest rate and q is the continuous dividend yield.

32. **(Currently Amended)** The method of Claim [[17]] <u>19</u>, wherein, when the option is exercised at a sub-period of time i corresponding to a node, the value for node vega at the node is computed as $\frac{\partial C_i}{\partial \sigma} = \frac{\partial S_i}{\partial \sigma}$, where S_i is the security price at the beginning of the sub-period of time i and σ is volatility.

33. **(Currently Amended)** The machine of claim 24, wherein said machine is configured to compute a value for vega for the ~~binomial~~ tree using a recursive function of the values for node vega computed at the nodes,

wherein, when the option is not exercised at a sub-period of time i corresponding to a node the recursive function is $\frac{\partial C_i}{\partial \sigma} = (\frac{1}{R}) \times [p \frac{\partial C_{i+1}^{UP}}{\partial \sigma} + (1-p) \frac{\partial C_{i+1}^{DOWN}}{\partial \sigma} + (C_{i+1}^{UP} - C_{i+1}^{DOWN}) \frac{\partial p}{\partial \sigma}]$, where C_{i+1}^{UP} and C_{i+1}^{DOWN} are the option prices at the end of the sub-period i when the price moves up and down, respectively, σ is volatility, [[and]] p is a <u>risk-neutral</u> probability<u>, and *R=exp([r-q]h)*, where *h* is the size of the sub-period of time *i*, *r* is the interest rate and *q* is the continuous dividend yield</u>, and

wherein, when the option is exercised at a sub-period of time i corresponding to a node, the recursive function is $\frac{\partial C_i}{\partial \sigma} = \frac{\partial S_i}{\partial \sigma}$, where S_i is the security price at the beginning of the sub-period of time i and σ is volatility.

34. **(Currently Amended)** The method of claim 25, wherein said computing of a value for vega for the ~~binomial~~ tree is conducted using a recursive function of the values for node vega computed at the nodes,

wherein when the option is not exercised at a sub-period of time i corresponding to a node the recursive function is $\frac{\partial C_i}{\partial \sigma} = (\frac{1}{R}) \times [p \frac{\partial C_{i+1}^{UP}}{\partial \sigma} + (1-p) \frac{\partial C_{i+1}^{DOWN}}{\partial \sigma} + (C_{i+1}^{UP} - C_{i+1}^{DOWN}) \frac{\partial p}{\partial \sigma}]$, where C_{i+1}^{UP} and C_{i+1}^{DOWN} are the option prices at the end of the sub-period i when the price moves up and down, respectively, σ is volatility, [[and]] p is a <u>risk-neutral</u> probability<u>, and</u>

$R=exp([r-q]h)$, where h is the size of the sub-period of time i, r is the interest rate and q is the continuous dividend yield, and

wherein, when the option is exercised at a sub-period of time i corresponding to a node, the recursive function is $\frac{\partial C_i}{\partial \sigma}=\frac{\partial S_i}{\partial \sigma}$, where S_i is the security price at the beginning of the sub-period of time i and σ is volatility.

35. **(Currently Amended)** The machine of Claim 28, wherein said computing device is configured ~~to use the Newton-Raphson method~~ to iteratively calculate the value of [[for]] the implied volatility of the American option using the values calculated for vega for the trees, using the Newton-Raphson method.